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PATENT & TRADEMARK OFFICE

Applicant: Preston F. Crow et al
U.S.S.N.: 10/644,458
Title: VERSATILE INDIRECTION IN AN EXTENT BASED FILE SYSTEM
Filing Date: 8/20/2003/ Docket No.: EMC-99-026CON1
Attorney: Scott A. Ouellette, Esq. (Reg. No. 38,573)

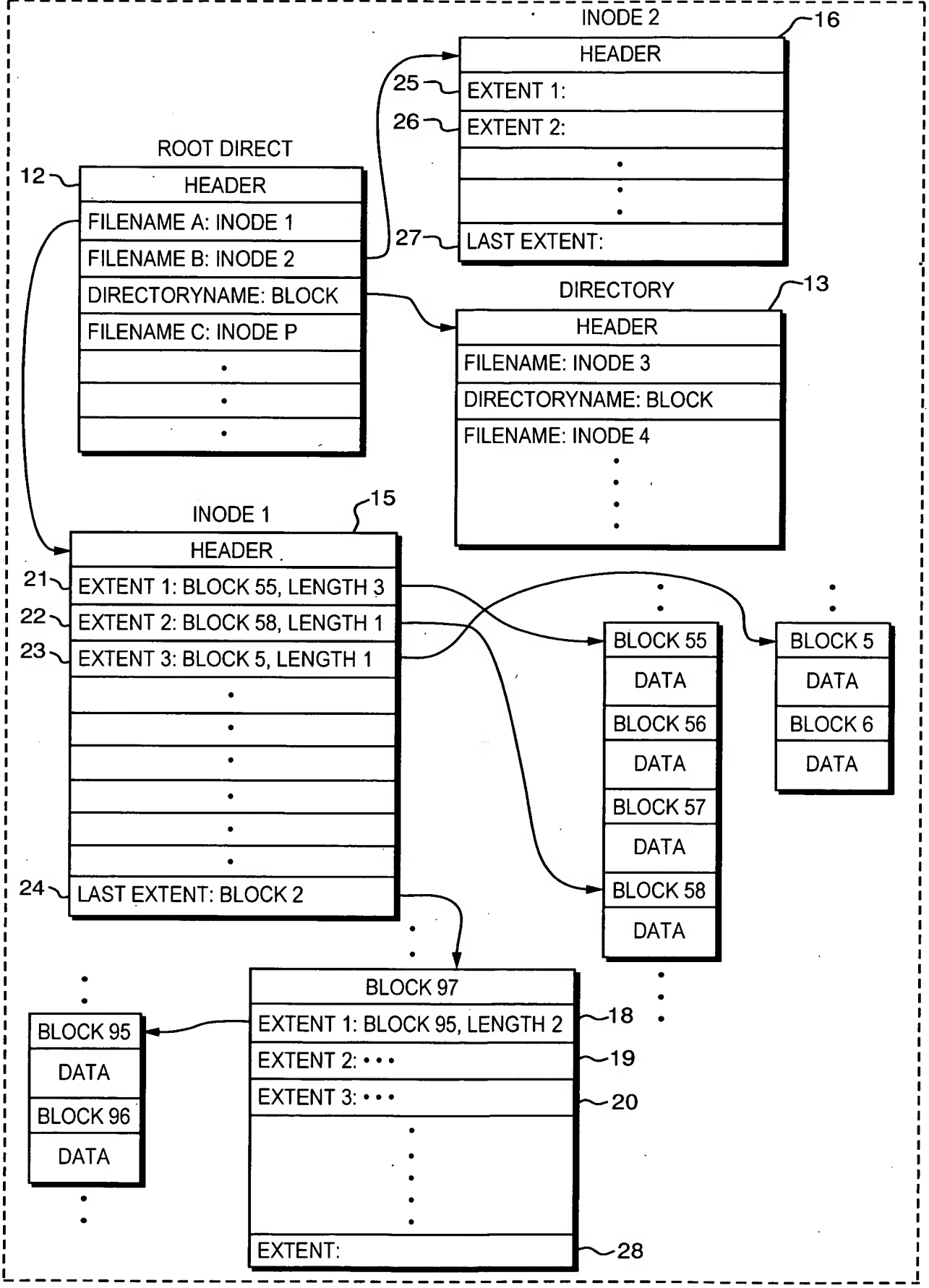

FIG. 1 (PRIOR ART)

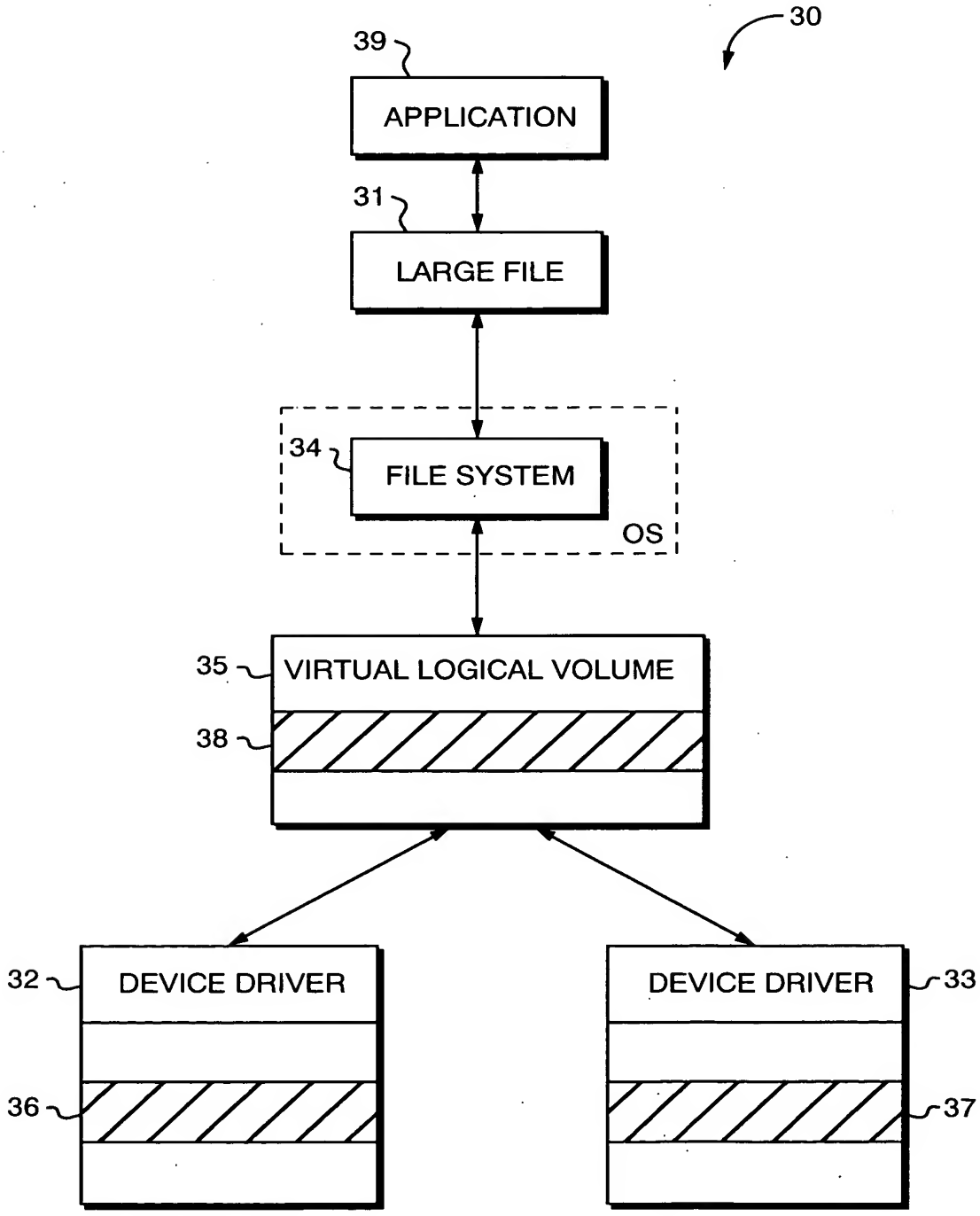

FIG. 2
(PRIOR ART)

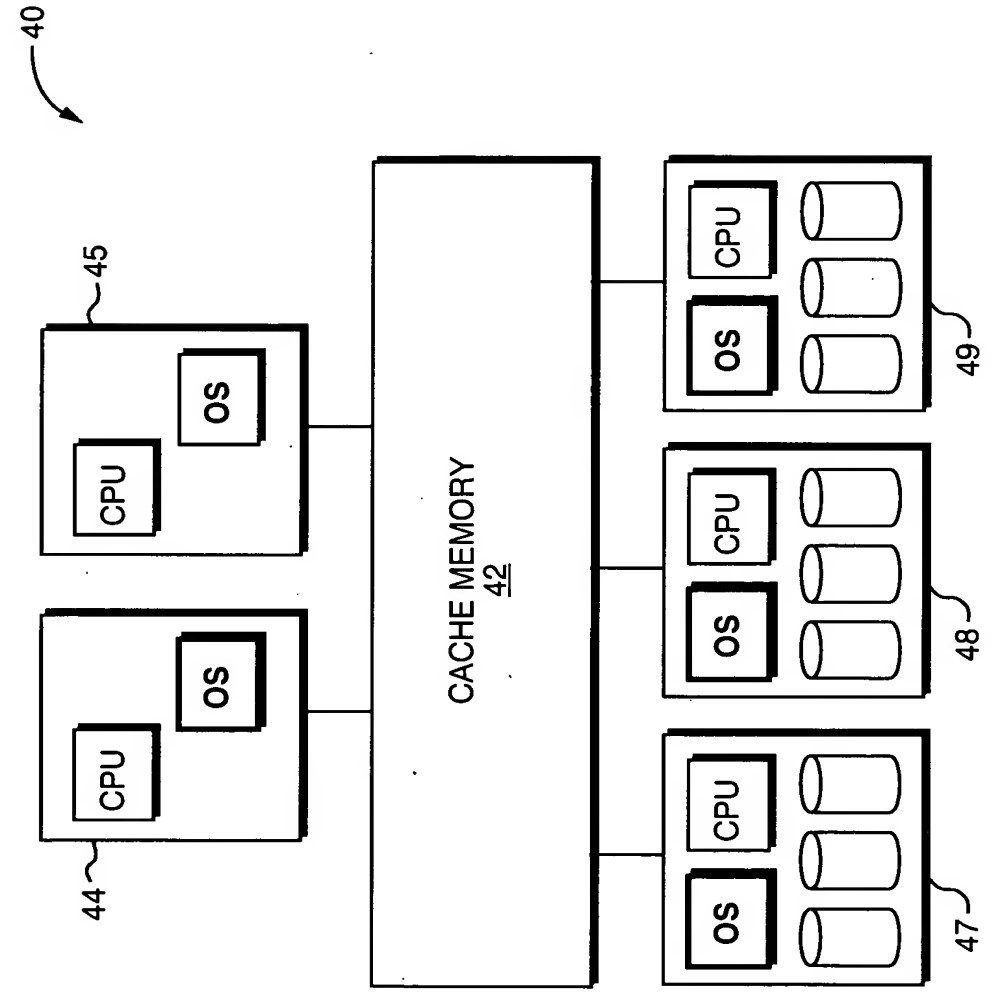

FIG. 3

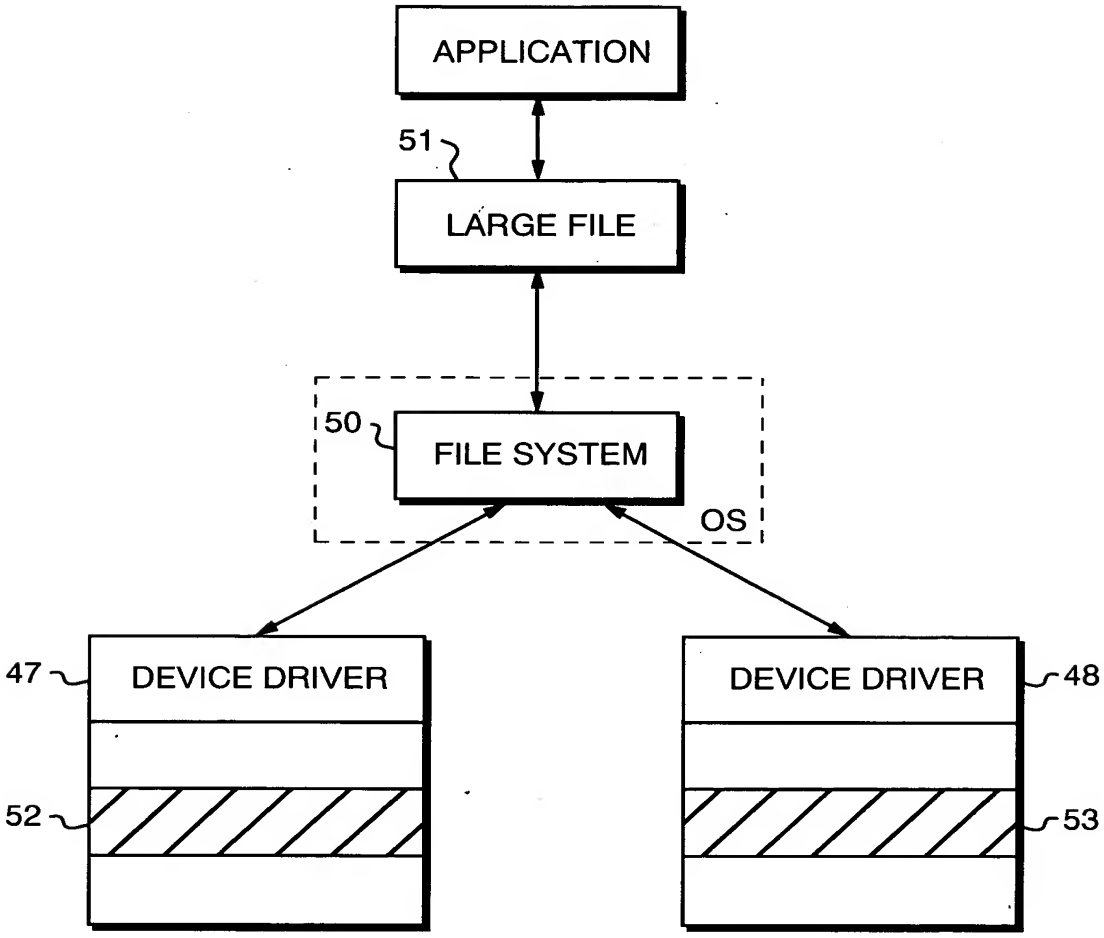
APPLICATION
51
LARGE FILE
50
FILE SYSTEM
OS
47
DEVICE DRIVER
48
DEVICE DRIVER
52
53

FIG. 4

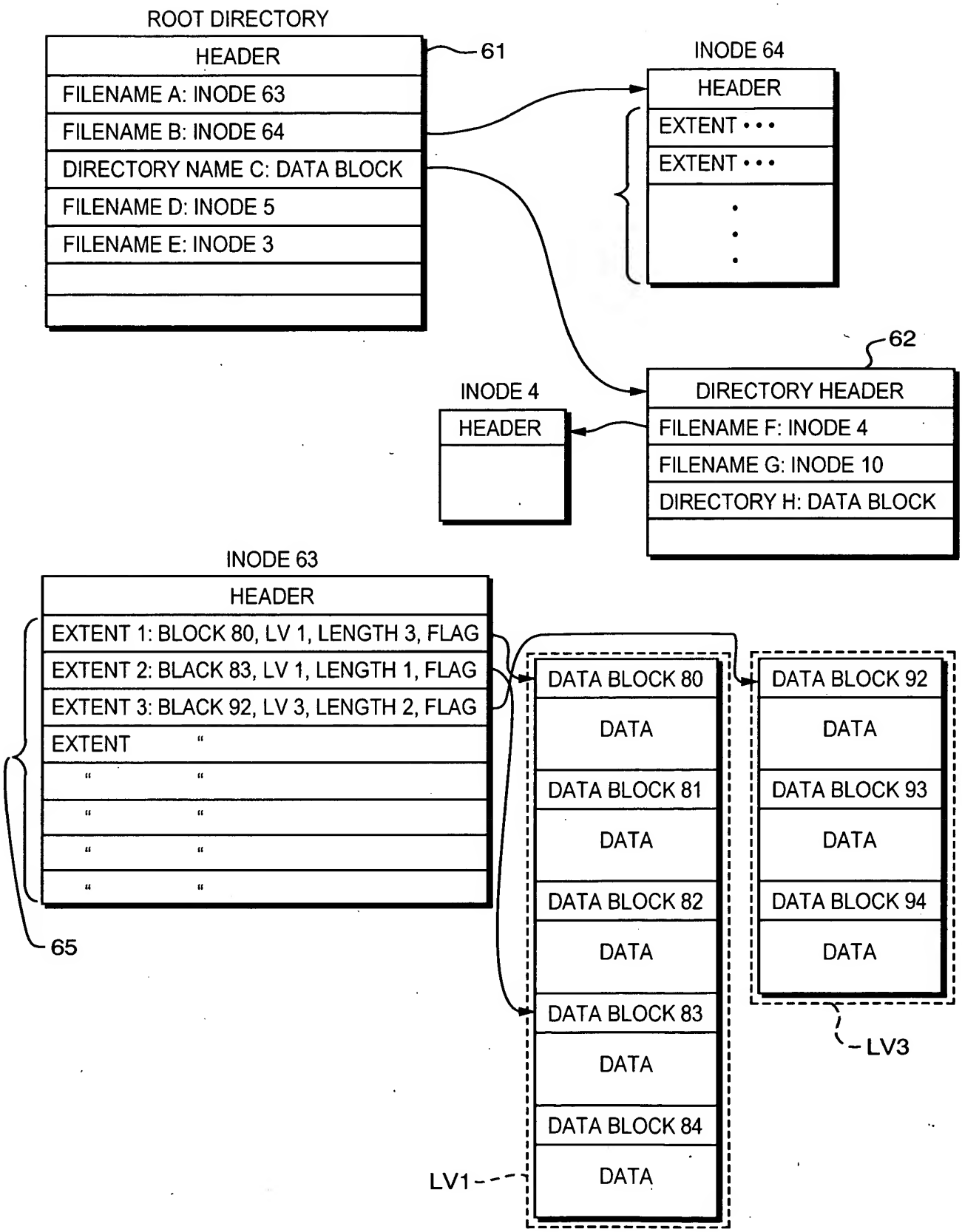
ROOT DIRECTORY
HEADER
FILENAME A: INODE 63
FILENAME B: INODE 64
DIRECTORY NAME C: DATA BLOCK
FILENAME D: INODE 5
FILENAME E: INODE 3
61
INODE 64
HEADER
EXTENT • • •
EXTENT • • •
62
DIRECTORY HEADER
FILENAME F: INODE 4
FILENAME G: INODE 10
DIRECTORY H: DATA BLOCK
INODE 4
HEADER
INODE 63
HEADER
EXTENT 1: BLOCK 80, LV 1, LENGTH 3, FLAG
EXTENT 2: BLACK 83, LV 1, LENGTH 1, FLAG
EXTENT 3: BLACK 92, LV 3, LENGTH 2, FLAG
EXTENT
65
DATA BLOCK 80
DATA
DATA BLOCK 81
DATA
DATA BLOCK 82
DATA
DATA BLOCK 83
DATA
DATA BLOCK 84
DATA
LV1
DATA BLOCK 92
DATA
DATA BLOCK 93
DATA
DATA BLOCK 94
DATA
LV3

FIG. 5

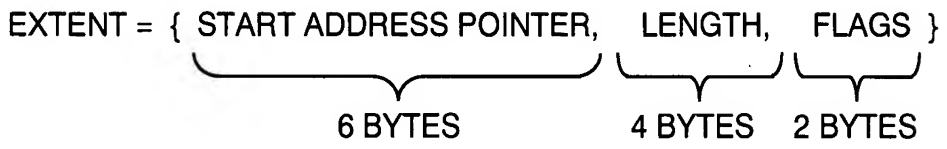

FIG. 6A

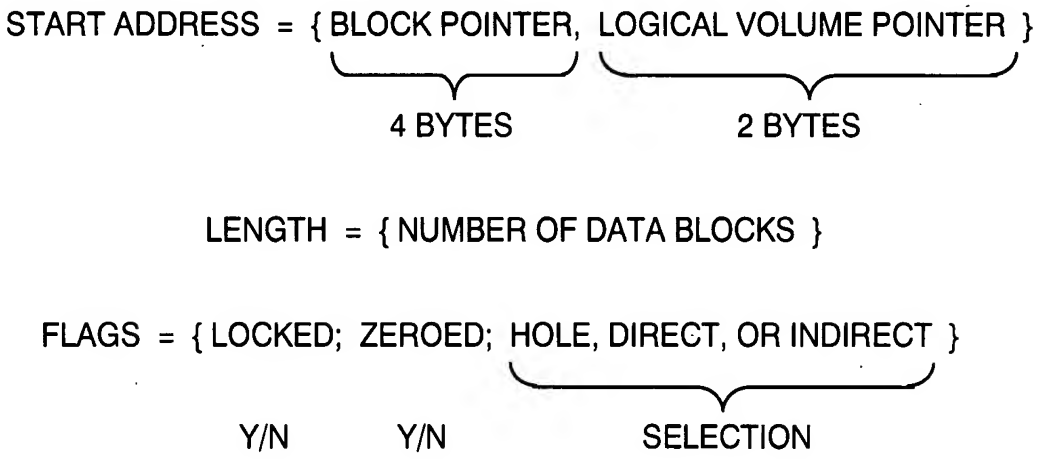

FIG. 6B

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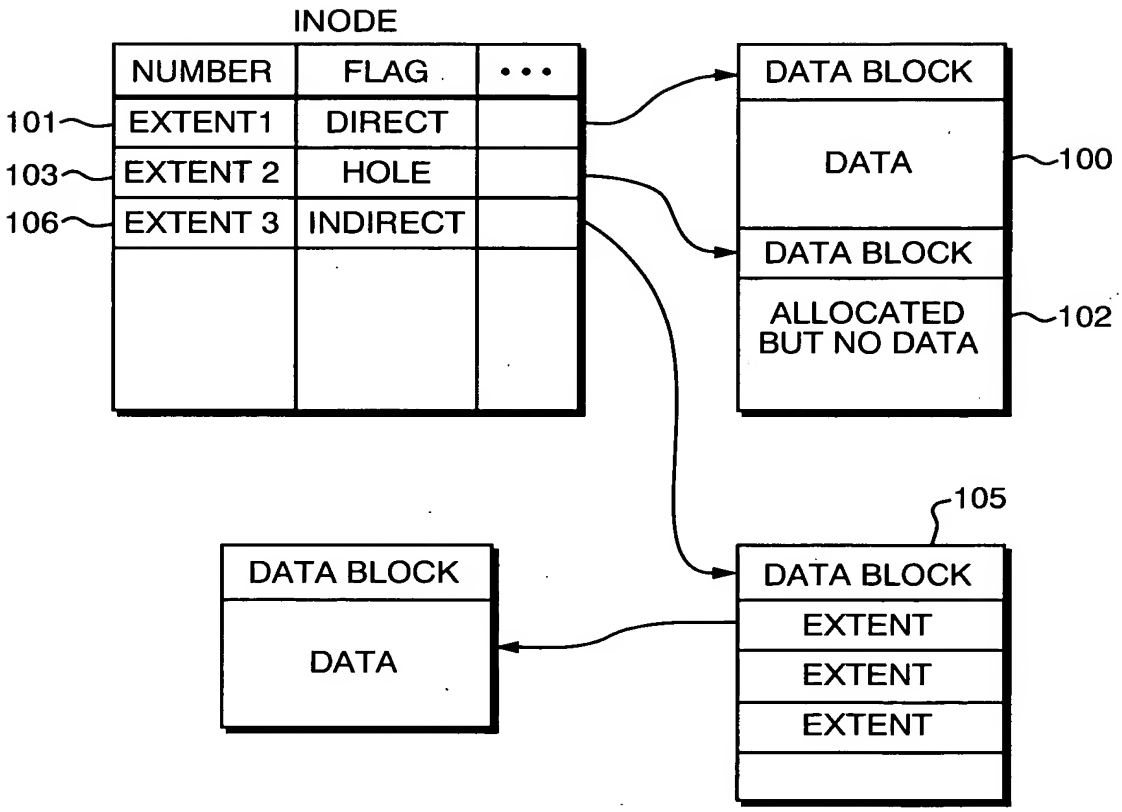
INODE
NUMBER
FLAG
• • •
101
EXTENT1
DIRECT
103
EXTENT 2
HOLE
106
EXTENT 3
INDIRECT
DATA BLOCK
DATA
100
DATA BLOCK
ALLOCATED BUT NO DATA
102
105
DATA BLOCK
DATA
DATA BLOCK
EXTENT
EXTENT
EXTENT

FIG. 7

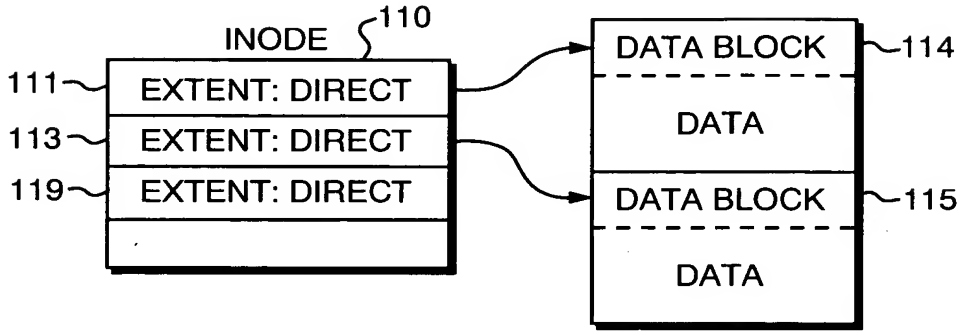
INODE
110
111
EXTENT: DIRECT
113
EXTENT: DIRECT
119
EXTENT: DIRECT
DATA BLOCK
114
DATA
DATA BLOCK
115
DATA

FIG. 8A

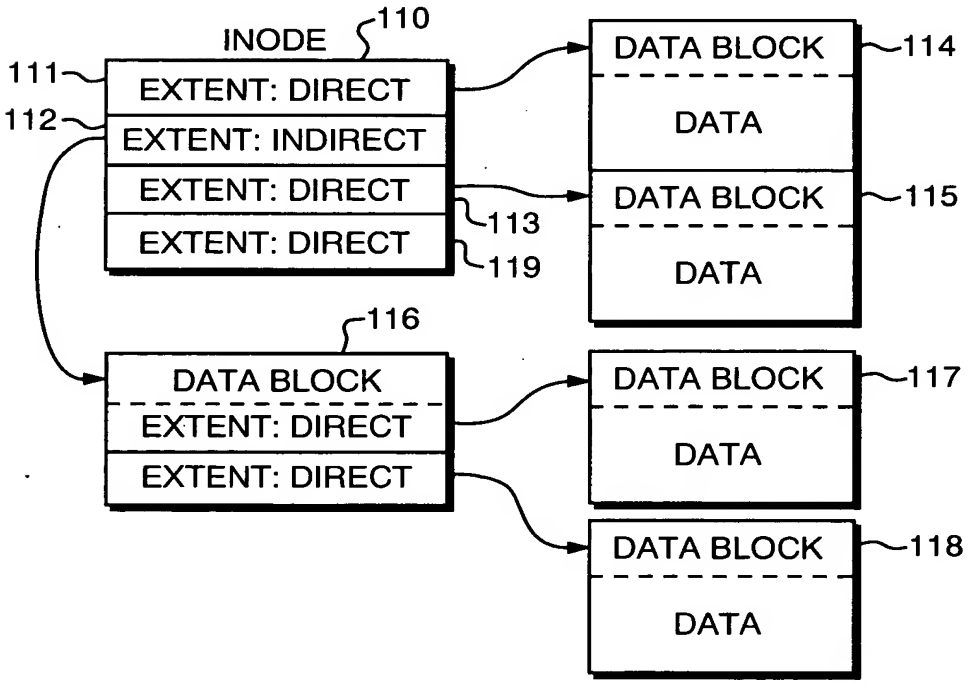
INODE
110
111
EXTENT: DIRECT
112
EXTENT: INDIRECT
EXTENT: DIRECT
113
EXTENT: DIRECT
119
116
DATA BLOCK
EXTENT: DIRECT
EXTENT: DIRECT
DATA BLOCK
114
DATA
DATA BLOCK
115
DATA
DATA BLOCK
117
DATA
DATA BLOCK
118
DATA

FIG. 8B

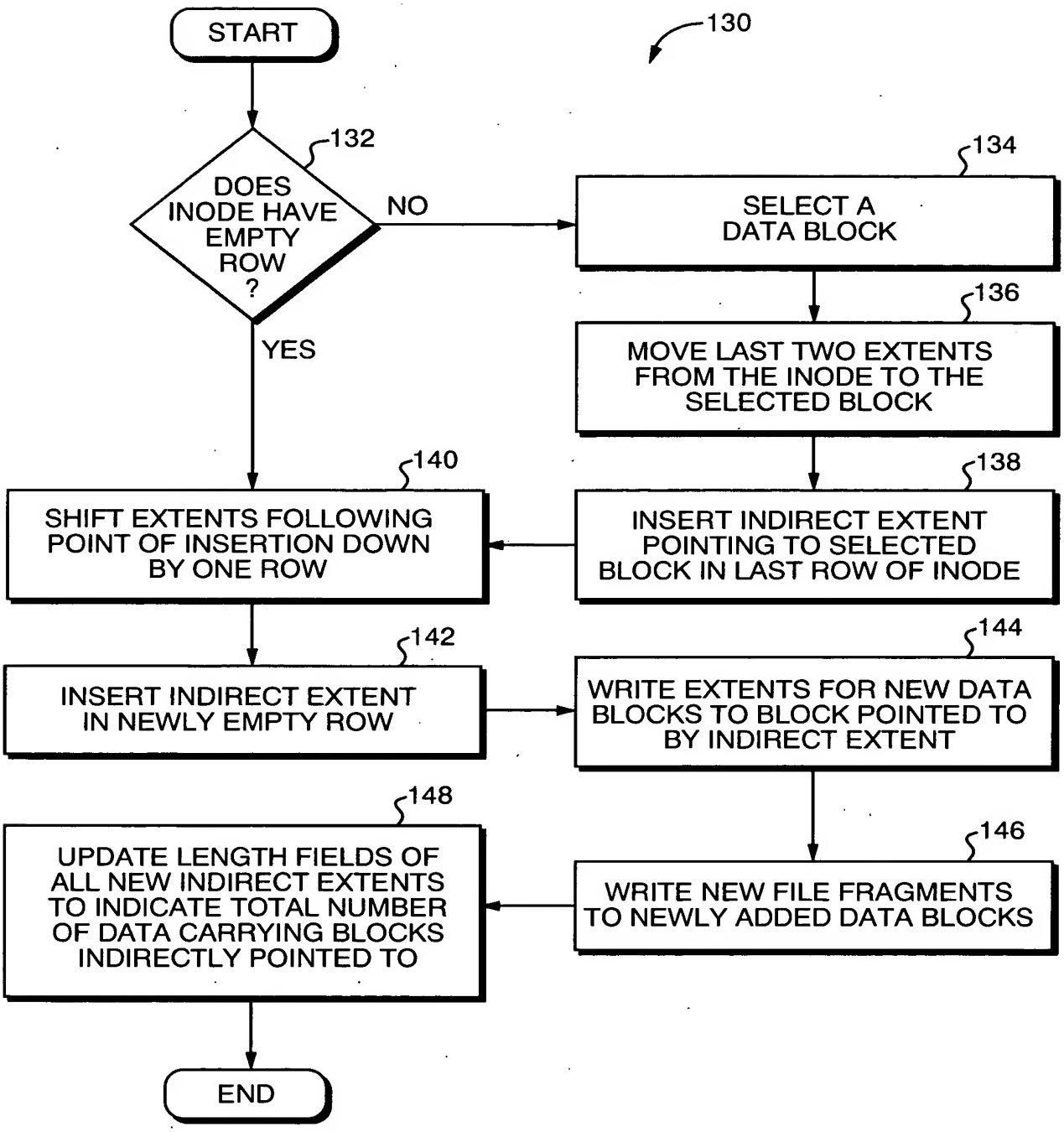
START
130
132
DOES INODE HAVE EMPTY ROW ?
NO
YES
134
SELECT A DATA BLOCK
136
MOVE LAST TWO EXTENTS FROM THE INODE TO THE SELECTED BLOCK
138
INSERT INDIRECT EXTENT POINTING TO SELECTED BLOCK IN LAST ROW OF INODE
140
SHIFT EXTENTS FOLLOWING POINT OF INSERTION DOWN BY ONE ROW
142
INSERT INDIRECT EXTENT IN NEWLY EMPTY ROW
144
WRITE EXTENTS FOR NEW DATA BLOCKS TO BLOCK POINTED TO BY INDIRECT EXTENT
146
WRITE NEW FILE FRAGMENTS TO NEWLY ADDED DATA BLOCKS
148
UPDATE LENGTH FIELDS OF ALL NEW INDIRECT EXTENTS TO INDICATE TOTAL NUMBER OF DATA CARRYING BLOCKS INDIRECTLY POINTED TO
END

FIG. 8C

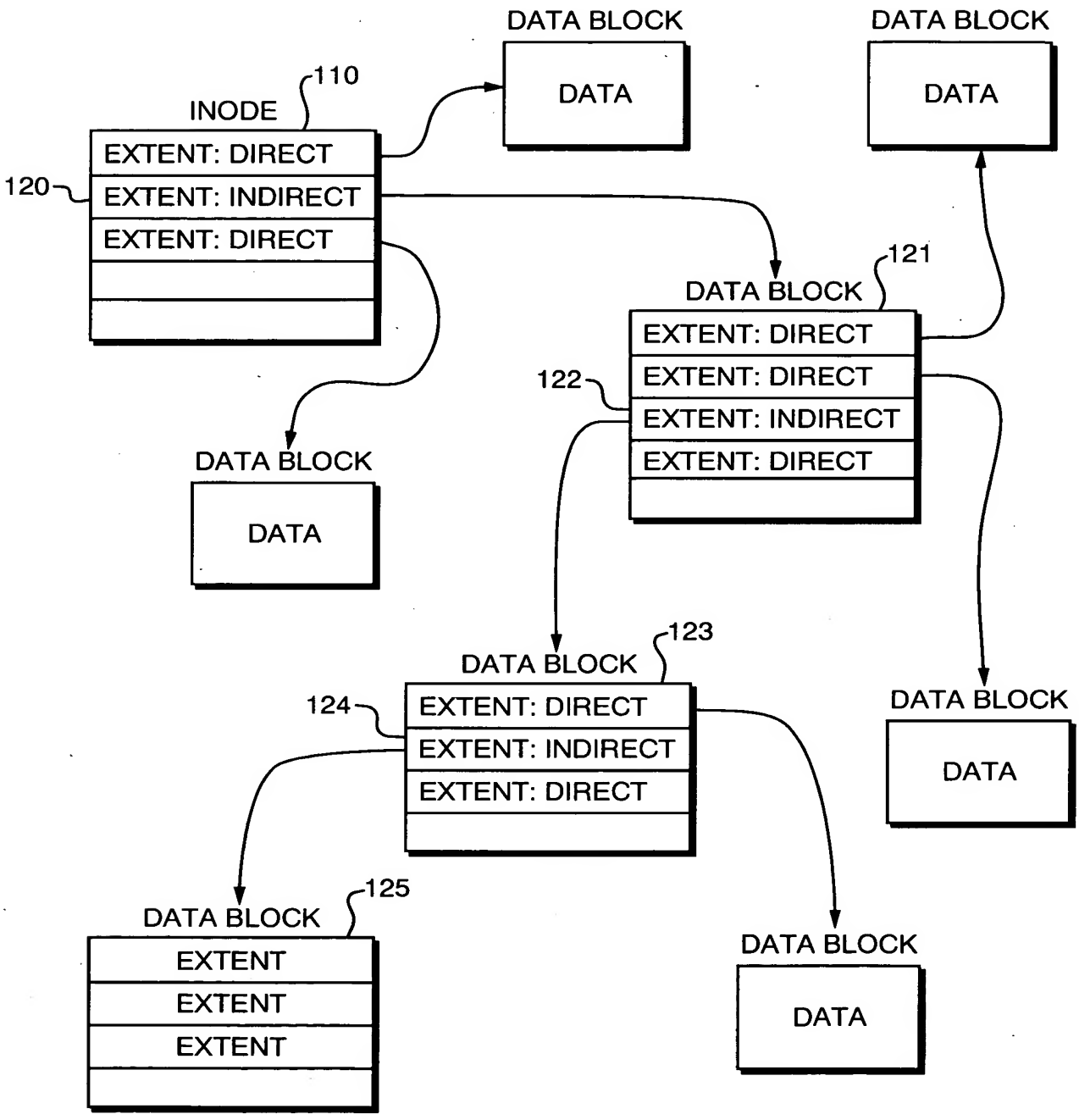
DATA BLOCK
DATA
DATA BLOCK
DATA
110
INODE
EXTENT: DIRECT
120
EXTENT: INDIRECT
EXTENT: DIRECT
121
DATA BLOCK
EXTENT: DIRECT
EXTENT: DIRECT
122
EXTENT: INDIRECT
EXTENT: DIRECT
DATA BLOCK
DATA
123
DATA BLOCK
124
EXTENT: DIRECT
EXTENT: INDIRECT
EXTENT: DIRECT
DATA BLOCK
DATA
125
DATA BLOCK
EXTENT
EXTENT
EXTENT
DATA BLOCK
DATA

FIG. 9

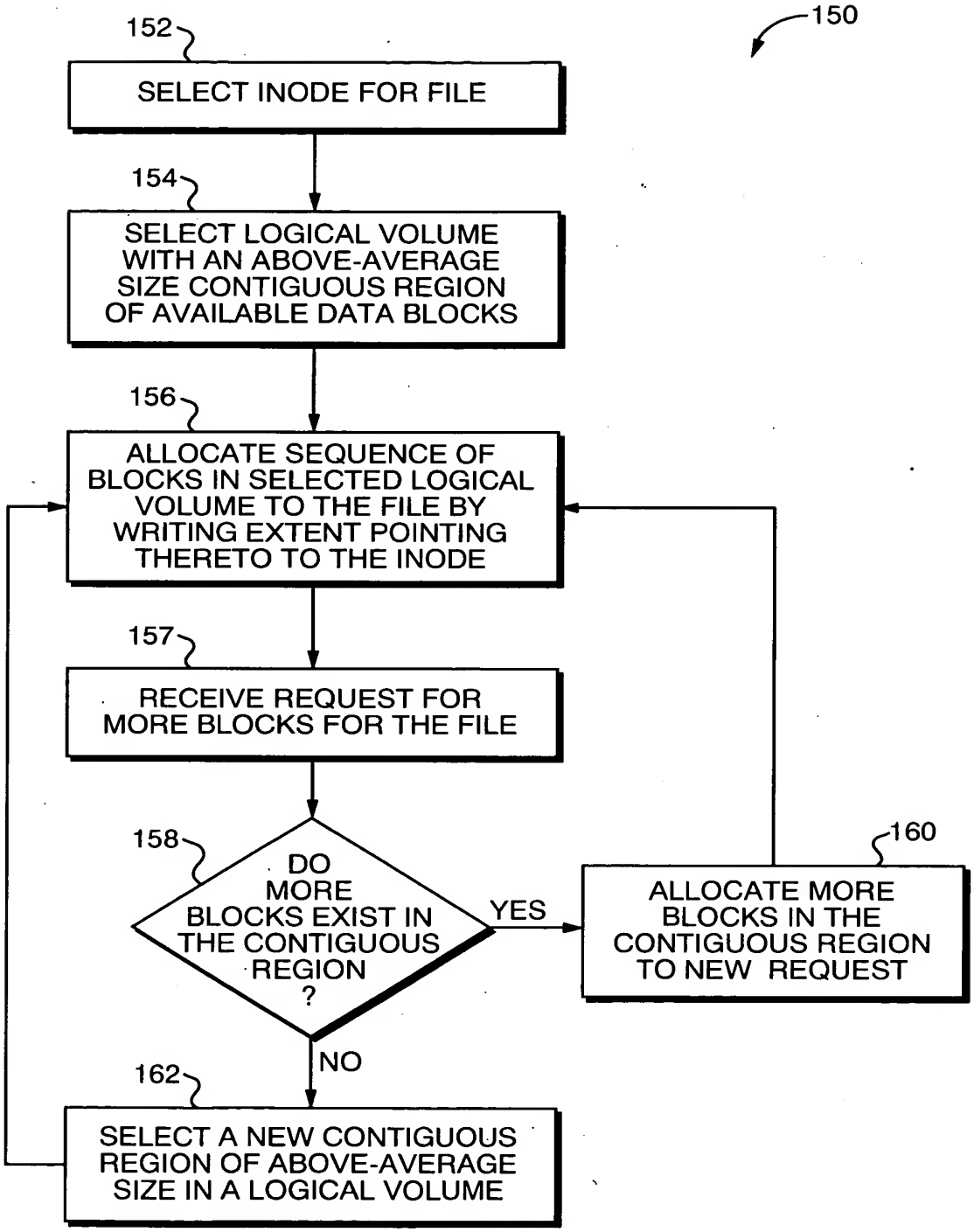
150
152
SELECT INODE FOR FILE
154
SELECT LOGICAL VOLUME WITH AN ABOVE-AVERAGE SIZE CONTIGUOUS REGION OF AVAILABLE DATA BLOCKS
156
ALLOCATE SEQUENCE OF BLOCKS IN SELECTED LOGICAL VOLUME TO THE FILE BY WRITING EXTENT POINTING THERETO TO THE INODE
157
RECEIVE REQUEST FOR MORE BLOCKS FOR THE FILE
158
DO MORE BLOCKS EXIST IN THE CONTIGUOUS REGION ?
YES
160
ALLOCATE MORE BLOCKS IN THE CONTIGUOUS REGION TO NEW REQUEST
NO
162
SELECT A NEW CONTIGUOUS REGION OF ABOVE-AVERAGE SIZE IN A LOGICAL VOLUME

FIG. 10

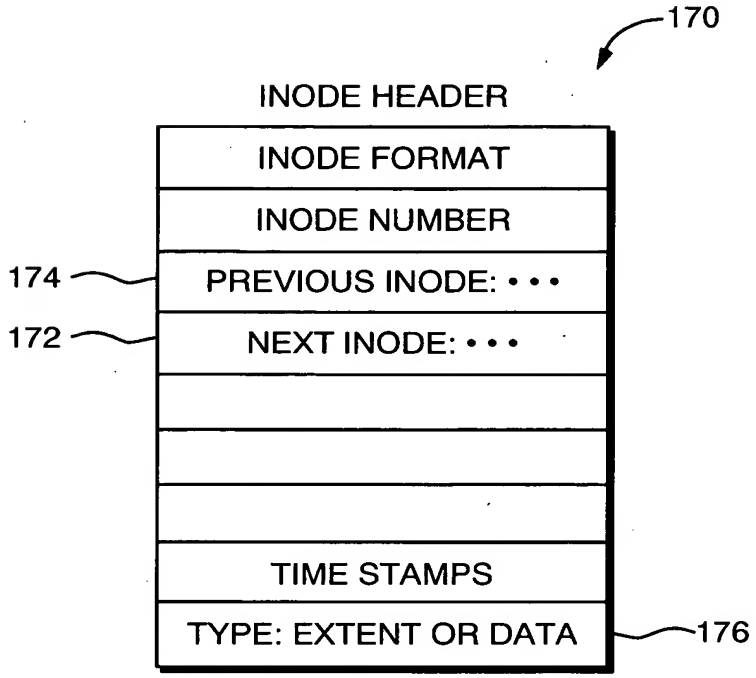
170
INODE HEADER
INODE FORMAT
INODE NUMBER
174
PREVIOUS INODE: • • •
172
NEXT INODE: • • •
TIME STAMPS
TYPE: EXTENT OR DATA
176

FIG. 11